Amendment to Solicitation DE-PS26-00FT40759

1. Entire Solicitation

Change all references to the Federal Energy Technology Center (FETC) to National Energy Technology Laboratory (NETL).

Delete Areas of Interest 11), 12), and 13) and all information pertaining to them.

Add Area of Interest, 15) Oil Technology -- Emerging Process Technology.

2. SECTION I – INTRODUCTION

B. <u>Solicitation Objective</u>

The closing date for Round 2 of proposals is hereby extended from May 22, 2000 to June 2, 2000. In the event you submitted a proposal for evaluation in Round 1, and you did not receive notification of selection and/or rejection, you may re-submit a proposal for consideration in Round 2. DOE will not automatically roll forward any rejected proposals from the Round 1 evaluation for re-consideration in Round 2.

Further, at this point in time, the DOE does not intend to add a third round of proposals for this solicitation. Rather, DOE anticipates that a broad based agency solicitation will be issued in the late summer/fall of 2000 for proposals to be funded in fiscal year 2001 using fiscal year 2001 funds.

3. SECTION II – CONDITIONS AND NOTICES

G. Estimated Value and Number of Awards

Replace the row of the table containing 1) Gasification Technologies with the following row:

1) Gasification Technologies	Advanced Gasification, Co-feeding Alternative Feedstocks	$2 mil	1 to 3

Replace the row of the table containing 2) Transportation Fuels and Chemicals with the following row:

2) Transportation Fuels and Chemicals	Reactor/Process Development, Process Evaluation, Product Upgrading/Testing	$500k	1 to 4

Replace the row of the table containing 5) Advanced Fuels Research and Specialty Markets with the following row:

5) Advanced Fuels Research and Specialty Markets	Studying production of fuels/ chemicals directly from coal, studying production of high-value carbon materials from coal, investigating biomimetic catalysts for production of oxygenates from syngas, new hydrogen generation schemes, creation of a knowledge base for solid-solid and solid-liquid separations that crosscuts the mining and mineral recovery industries.	$1.5 mil	1 to 5

Replace the row of the table containing 9) Natural Gas Supply and Infrastructure with the following row:

9) Natural Gas Supply and Storage	Drilling, Completion, and Stimulation	Up to $3.0 mil	Up to 4
	Gas Hydrates Research	Up to $3.0 mil	Up to 4
	Engineering/Market Analysis Gas Storage	Up to $200k	Up to 2
	Stripper Wells	Up to $200k	Up to 2
	Arctic Research	Up to $750k	Up to 2

Replace the row of the table containing 10) Gas to Liquids (Natural Gas Processing) with the following row:

10) Gas to Liquids (Natural Gas Processing)	Fischer-Tropsch (FT) Process Components/Integration, Product Tailoring	$500k	1 to 3
	Gas Upgrading	$150k	1 to 2

Replace the row of the table containing 14) Oil and Gas – Effective Environmental Protection with the following row:

14) Oil and Gas -- Effective Environmental Protection	Air emissions, waste handling and disposal, remediation, regulatory streamlining, and issues affecting access to public lands, for oil and gas exploration and production operations	Up to $3.75 mil	4-14

Add the following row to the end of the table:

15) Oil Technology -- Emerging Processing Technology	Develop/enhance diesel biocatalytic desulfurization technology for the efficient removal of sulfur compatible with Alaskan refineries using North Slope crude oil.	Up to $3.3 mil	1

4. SECTION III – APPLICATION PREPARATION INSTRUCTIONS

B. Funding, Scope, and Appropriate Activities for Proposed Projects

Delete the table. This information can be found in **SECTION II – CONDITIONS AND NOTICES**, **G. Estimated Value and Number of Awards**.

C. Overall Arrangement of Application

Change the number of electronic versions of Volume I – Business and Financial Application from "1" to "0."

Change the text after the asterisk to read: "The electronic version of the technical application shall be submitted in Word 97, WordPerfect 6.1 or Adobe Acrobat Portable Document Format (PDF). The preferred media is a 3.5 inch disk."

C.2 Volume II – Technical Application

Replace the text under "A. General" with the following:

The proposer shall include a technical discussion in the format specified below. This format relates to the technical evaluation criteria, Section IV - E. Proposers are asked to follow the outline shown on the following page. Alternate heading names and additional headings may be included as desired. The discussion of items 1., 2., 3., and 4. in the Table of Contents below must not exceed 35 pages (double spaced, 12 point font, 1 inch margins). The entire Technical Volume (including everything shown in the Table of Contents below) must not exceed 50 pages. Pages exceeding the 35-page (for Table Contents items 1., 2., 3., and 4) and/or 50-page limit (for Technical Volume) may be ignored.

Replace the paragraphs **Science and Technical Merit** and **Technical Approach and Understanding** with the following:

Scientific and Technical Merit: The applicant should consider and discuss the following factors: (1) the degree to which the technology relates to the "Research Objectives for this Solicitation" in the targeted Area of Interest; (2) whether the concept is scientifically significant and/or technically challenging, (3) the extent to which the proposed work moves beyond the current state-of-the-art, (4) whether the approach is readily distinguishable from past and current practice and investigations, (5) the possibility of a scientific or engineering breakthrough, (6) the extent to which the application of the proposed concept would improve the efficiency of fossil energy technologies, and (7) the expected compatibility of the technology with the environment, including protection of human health and sensitive ecosystems.

Technical Approach and Understanding: The applicant should discuss (1) the soundness and level of adequacy of the proposed work to show progress toward proving the feasibility of the proposed concept; (2) the degree to which the R&D is likely to produce ancillary benefits; (3) the technical basis for the proposed work, including discussions of relevant technical issues, existing technical barriers, and pertinent research, both past and current; (4) the manner in which the offeror proposes to accomplish the work, including identification of anticipated problems and proposed solutions; and (5) technology transfer efforts.

5. SECTION IV – EVALUATION AND SELECTION

E. <u>Technical Evaluation Criteria</u>

In Criterion 1, change the first sentence to read:

Degree to which the proposed technology or methodology, if successfully developed as proposed, represents an important advancement toward achieving the "Research Objectives for this Solicitation" in the targeted Area of Interest.

Delete the word "Facilities" from the title of Criterion 3.

6. SECTION VI – ATTACHMENTS, ATTACHMENT A

Change heading "Goals" to "Overall Program Goals."

Change heading "Research Objectives" to "Research Objectives for this Solicitation."

Under **1) GASIFICATION TECHNOLOGIES**

Replace the second Research Objective (**2. By-Product Utilization**) with the following:

2. **Advanced Gasification:** Many market opportunities exits for gasification technologies that can process low-value, high ash coals and/or waste coals. In many such areas, access also exists to other potential carbon-based fuels such as imported coals, wastes, and biomass. In order to utilize this large resource of low value materials, gasifier designs and performance specifications need to be developed to efficiently and economically process high ash coals/waste coals as well as other carbon-based feedstocks e.g., biomass, municipal solid waste, petroleum coke, etc., separately and in combination with one another. Such process must produce a gaseous product that is capable of being converted to a variety of products including electricity, fuels, hydrogen, and chemicals at existing market prices.

End Change to Area 1 Description

Replace **2) TRANSPORTATION FUELS & CHEMICALS** with the following:

2) TRANSPORTATION FUELS & CHEMICALS

Background

Transportation Fuels & Chemicals (TF&C) is a market-driven, product-oriented program that supports applied research directed toward producing ultra-clean transportation fuels and developing more efficient processes for manufacturing chemicals. The feedstock is coal, alone or in combination with other carbon-based feedstocks. The present R&D emphasis is on the conversion of synthesis gas (carbon monoxide and hydrogen) to the desired products, but other processes are acceptable if they meet the economic, environmental and quality criteria demanded by the market. The synthesis gas route has the advantage that, in addition to coal, it can also be used to convert natural gas, refinery wastes, municipal wastes and biomass to high-value products.

The principal program driver is clearly environmental. Vehicles currently account for a large portion of urban and regional air pollution, including carbon monoxide, nitrogen oxides, volatile organic compounds, and particulates. A strong market demand is emerging for fuels that, in combination with advanced engines and exhaust gas treatment, produce extremely low emissions. Tests have already shown, for example, that diesel fuel produced via the Fischer-Tropsch (F-T) conversion of synthesis gas result in significant reductions of particulates, carbon monoxide and other pollutants when compared to present diesel fuel used in standard, unmodified diesel engines.

The TF&C program also addresses the needs of the chemical industry for more efficient, lower cost manufacturing processes. Past TF&C supported research has led to the very successful demonstration of the Liquid Phase Methanol(LPMEOH^{TM}) Process in the Clean Coal Technology Program. This process differs from traditional methods for making methanol in that it uses powdered rather than pellet catalyst and a slurry reactor instead of a fixed bed version. The slurry reactor system has many advantages, including

lower cost, better plant operability and purer methanol product. Research on other chemical products may lead to equally positive results.

Overall Program Goals

- Help the U.S. transportation industry develop technologies that will enable it to expand the global fossil resource base upon which to produce affordable, ultra-clean transportation fuels.

- Facilitate the establishment of a new U.S. industry that produces significant quantities of ultra-clean fuels from domestic resources of coal.

- Help the U.S. chemical industry develop advanced processes for manufacturing chemicals.

- Reduce CO_2 and other greenhouse gases through life cycle engineering.

Research Objectives for this Solicitation

♦ **Reactor/Process Development**

Develop technologies for the efficient conversion of coal, alone or in combination with some other feedstock (such as biomass or carbonaceous waste), to clean transportation fuels, fuel blending stocks or additives and chemicals.

Develop ancillary technologies that will facilitate the commercial deployment of coal conversion systems. Examples include: sturdy iron-based catalysts, improved catalyst activation procedures, efficient catalyst/wax separation techniques, advanced methods for hydrogen/synthesis gas production and gas separation, and continued development of slurry reactor technology.

♦ **Process Evaluation**

Evaluate and optimize conversion technologies through testing at laboratory-, bench-, or proof-of-concept -scale, either alone or integrated with other processes.

♦ **Product Upgrading/Testing**

Develop the refining strategy for making ultraclean fuels from the products of advanced conversion processes.

Characterize and evaluate ultraclean fuels to determine the impact of fuel properties on engine performance and emissions.

End Area 2 Description

Replace **5) ADVANCED FUELS RESEARCH AND SPECIALTY MARKETS** with the following:

5) ADVANCED FUELS RESEARCH AND SPECIALTY MARKETS

Background

The Advanced Fuels Research and Specialty Markets Product Line is charged with providing the technical basis for, and promoting the development and deployment of, cost-effective technologies that will enable fossil fuels to continue to provide the energy baseline for the world in an environmentally responsible manner. The several, complex products of the Advanced Fuels Research Program consist of knowledge bases underpinning fuels and separation technologies related to fuels and minerals production and a suite of advanced technologies and databases that facilitate the highly efficient, cost-effective, and environmentally friendly conversion of fossil resources into fuels, feedstocks, and other high-value products. This product area provides the knowledge base for production of ultraclean fuels, chemicals, and value added products from coal, alone or in combination with other hydrocarbon feedstocks (such as biomass or carbonaceous waste), as well as the scientific and engineering knowledge base with which industry can produce economically competitive and environmentally acceptable clean fuel products and feedstocks for introduction as U.S. and world market conditions warrant.

Overall Program Goals

- Provide the enabling science to develop safe production, separation and storage of hydrogen from fossil resources.

- Provide the enabling science to produce premium fuels and chemicals from C1 compounds such as CO, CH_4, CO_2, and methanol and its derivatives.

- Provide the enabling science to produce attrition resistant catalysts for multi-phase reactors.

- Provide the enabling science to develop reaction schemes that avoid the limitations of the Schultz-Flory-Anderson equation and produce greater fractions of desired products in F-T reactions.

- Provide the enabling science to permit the economic recovery of coal and other materials now lost as waste or already disposed of in waste ponds and discard coal piles.

- Provide the enabling science to develop radical improvements in the handling/transportation of various solid fuels.

Research Objectives for this Solicitation

- Study the basic science and technology of separations, such as solid-solid and solid-liquid, that are important to the mining and minerals processing industries.

- Study production of fuels and chemicals directly from coal by using an extractive process that minimizes processing and solvent costs and that may be integrated into a coproduction plant.

- Study production of high value carbon materials from coal by using an extractive process that minimizes processing and solvent costs and that may be integrated into a coproduction plant.

- Investigate the use of biomimetic catalysts for production of oxygenates from syngas.

- Explore new hydrogen generation schemes at the laboratory scale.

- Explore the production of attrition resistant catalysts for multi-phase reactors.

End Area 5 Description

Replace **7) ADVANCED TURBINES AND ENGINES** with the following:

7) ADVANCED TURBINES AND ENGINES

Background

The Advanced Turbine Systems (ATS) program, now in its 9th year, is providing cleaner, more efficient gas turbine systems for energy and industrial sectors with state-of-the-art options for both very large utility scale (400 MW) and industrial scale (under 20 MW), turbine-based power plants. In response to a need for continued development of advanced turbines and engine systems as expressed by a broad stakeholders base, DOE is implementing a follow-on to the ATS program, the Next Generation Turbine Systems Program. The program is targeting central and distributed power markets, mechanical drive, and dual use applications such as defense or marine markets. The Next Generation Turbine Program includes three elements: 1. **Power Systems Development**; 2. **Crosscutting Research and Development** required to support next generation system design and testing; and 3. **Power Plant Technology** needed for operation/ maintenance of advanced turbine-based power plants.

Overall Program Goals

The overall program goal is to develop next generation turbine systems greater than 30MW in output rating with operational capability, cost and performance that will result

in significant public benefits to the United States. These systems will serve market needs not covered by the ATS Program and in the long term be integrated into Vision 21 power plants.

Next generation systems goals include:

Near Term, by the year 2010:

- Target natural gas but provide options to use renewable energy and coal-derived fuels.
- Address distributed generation, central station generation, both greenfield/ repowering applications, and gas compression markets.
- Develop and test flexible turbine systems greater than 30MW in output rating.
- Develop and test turbine/fuel cell hybrids and revolutionary concepts.

Long Term, by the year 2015:

- Scale-up and integrate flexible turbine systems, revolutionary concepts, and turbine/fuel cell hybrid power modules into Vision 21 plants.

Research Objectives for This Solicitation:

The scope of interest for this solicitation is the second and third elements of the program: Crosscutting Research/Development and Power Plant Technology. These elements broadly support research and development of next generation turbine power systems and power plant technology required for life cycle cost reduction, and optimal operation/ maintenance of existing, planned, and next generation turbine power plants.

- **Combustion systems technology needs include:** Emissions reduction technology such as catalytic systems, including catalytic combustors and thermally stable catalysts; lean pre-mix, or advanced designs to reduce levels of pollutant emissions to near zero levels; system designs to utilize multiple fossil and opportunity fuels; sensors, controls, and actuator development; technology for elimination of combustion dynamics; emissions sampling improvements; and improved after-treatment systems. These combustion systems should be reduced cost and embody significant improvements in durability and ease of operation.

- **Materials needs include:** High temperature, durable materials (ceramics/alloys) and protective coatings for the components in the hot-gas path of next generation turbine systems, sensors that will permit the operation and implementation of advanced designs, lifetime prediction modeling, and repair processes. Alloys and ceramics are needed to withstand ultra-high temperatures for hot gas path

components and system balance of plant. New sensing techniques require the sensing element be placed in an extreme service environment to make the desired measurements. The metal alloy(s) need sufficient mechanical properties to maintain its shape and provide stable sealing surfaces while in service.

- **Computational needs include**: Codes and methods for a significant level of improvement in predictive accuracy for gas turbine power systems design tools resulting in ease of application for full engine or multi-component simulation. Research topics include, but are not limited to, fast LES codes; RANS improvements; novel ideas such as lagrangian codes; and data analysis methods.

- **Power Plant Technology Computational needs include:** Diagnostics and controls; aero-thermal performance and degradation models; cycle analysis; condition monitoring systems and monitoring software for enhanced analysis and diagnostics; expert systems development; performance optimization; prognostics (predictions based on trend), rotor dynamics Vibration Analysis (Fast Fourier Transforms); life management tools; operational optimization and life cycle cost reduction of units and fleets of turbine power plants.

- **Sensors and Controls needs include:** systems to monitor the condition of coatings, and extend the life of hot-section components; techniques to monitor contaminants in fuels; smart and adaptive systems which can be replaced without power plant shutdown; neural networks to perform information management and generate adaptive controls; systems to measure thermal performance and predict incipient failures.

End Area 7 Description

Replace **9) NATURAL GAS SUPPLY AND INFRASTRUCTURE** with the following:

9) NATURAL GAS SUPPLY AND STORAGE

Background & Overall Program Goals

The goal of NETL's supply program is to ensure an abundant, economical supply of natural gas with minimal environmental impact. The many economic, environmental, and national security benefits of increased gas use will only be realized if our abundant natural gas resources can be converted into reserves (gas profitably producible at reasonable prices) at a pace necessary to support the growing demand. This requires a steady stream of new technology to: 1) increase production from conventional reservoirs in the near-term; 2) unlock the potential resources in low-permeability formations in the Rocky Mountains and other regions in the mid-term (in 2010 conventional reservoir production will peak); and, 3) develop entirely new sources such as very deep gas and methane hydrates after 2015.

To expand production from conventional reservoirs, NETL's Secondary Gas Recovery program is developing diagnostic tools to find overlooked compartments of gas behind, between, or below existing well bores. The Stripper Well program is ensuring that valuable gas resources are not abandoned prematurely and lost forever by developing tools that address the inadequacies of these marginal production wells.

To unlock the potential of more difficult and complex reservoirs classified as low-perm, NETL is conducting Resource and Reserve Assessments in partnership with other agencies to more fully understand the resource. In addition, NETL is developing natural fracture detection methods and technologies that precisely locate large pools of gas in these reservoirs without drilling large numbers of wildcat wells. Further, the application of NETL sponsored horizontal well technology allows more fractures to be tapped with fewer wells, thus, reducing the environmental footprint of drilling activity.

To meet long-term supply needs, NETL is developing technologies to tap new frontier resources such as very deep gas and methane hydrates. NETL's Deep Gas program is developing systems for faster drilling through the high temperature, high pressure, hard rock environment found below 16,000 ft well depths. NETL is working on revolutionary drilling systems with drill bits flexible enough to drill through a wide variety of rock formations equipped with "smart" information systems capable of "real-time" downhole monitoring. In the future, "smart" systems will allow drillers to more efficiently hit targets and avoid dangers with significantly higher penetration rates than any drilling system available today.

Methane hydrates are a tantalizing future source of natural gas. Potentially vast amounts of gas -- possibly 5,000 times larger than the world's known conventional gas reserves -- are locked in ice-like formations beneath the ocean floor and the Arctic tundra. But hydrates are also a possible safety threat to offshore drilling rigs and deep-sea pipelines. Releases of methane from hydrates could also pose a possible global warming concern. Many questions remain unanswered. NETL's Methane Hydrates Program is addressing up-front issues of seafloor stability, climate change, and hydrate resource characterization in preparation for and expanded program aimed at delivering the technologies needed to make hydrate production a reality.

Gas storage is a vital component of the nation's critical infrastructure, and as such reliability and system performance is important to the health and safety of the American people. Gas storage plays a critical role in the ability of the U.S. to increase use of natural gas as both an environmentally friendly fuel and as a key to greater energy independence. Improved gas storage technologies are necessary to enable the advanced and distributed power systems of the future envisioned in other program areas. NETL's storage program is divided into two areas. Conventional Storage Reservoir program focuses on deliverability enhancement, gas measurement, and reservoir management. The Advanced Storage Concepts Program includes Lined Rock Cavern, Refrigerated Mined Cavern, Hydrates, Salt Caverns , Basalt Aquifers, and Chilled Gas in Salt.

Research Objectives for This Solicitation:

- **Drilling, Completion, & Stimulation**

  Advancements in drilling, completion and stimulation technologies that enable producers to drill more cost effectively and with non-damaging formation fluids to improve production efficiency and to enhance control using smart systems. Also, innovative technologies with high potential for breakthroughs in drilling capability (for example, laser drilling, Arctic directional drilling, or other innovative technologies).

- **Hydrates Research**

  Initiate broad based research in gas hydrates to conduct research in areas of resource characterization, production, safety and seafloor stability, and climate change. This effort could include a well of opportunity which highly leverages NETL funding.

- **Gas Storage**

  Perform engineering, economic, and market studies of advanced storage concepts in non-reservoir rocks for both regional and on-site generation.

- **Stripper Wells**

  Initiate an industry-driven consortium or partnership to conduct research to improve production performance of stripper wells. Research will be in the area of the reservoir, the wellbore, and the surface. Each area could include subcategories. In the reservoir remediation area, such technologies could include restimulation, explosive/propellants, extended reach jetting technology, or identifying additional behind-pipe reserves among others. The wellbore clean-up area could include such things as perforation cleaning/re-opening, fluid removal, solids removal, or scale/salt removal. Low-pressure compression facilities, collection system optimization, and water disposal are just a few ideas which will fall under the surface system optimization area. This list is not all inclusive. The consortium or partnership must be industry-driven with industry providing significant cost-share and input into project proposals and selections. NETL will consider proposals that address Natural Gas Stripper Wells. In addition, proposals that address both gas and oil stripper wells will be considered in the event that it becomes possible for NETL to co-fund the proposal with the National Petroleum Technology Office. The proposed consortium or partnership should be set up to leverage DOE funding with available state and industry funding to the maximum extent possible and address the most essential research needs of stripper well operators.

- **Arctic Research**

  Advancements in drilling techniques that would reduce surface disturbance, reduce greenhouse gas emissions from North Slope drilling, develop heavy oil reserves, or develop Alaska's extremely low-sulfur coal reserves. This includes, but is not limited to, carbon sequestration, heavy oil recovery, and directional drilling technologies.

End Area 9 Description

Replace **10) GAS TO LIQUIDS (NATURAL GAS PROCESSING)** with the following:

10) GAS TO LIQUIDS (NATURAL GAS PROCESSING)

Background

Gas-to-Liquids (GTL) is an integral component of FE's Natural Gas Processing program which focuses on advancing technology, needed to make marketable, natural gas resources that are below acceptable pipeline quality and/or remote from pipeline access to markets. GTL product activity emphasis is on chemically changing gas to a stable, ultra-clean burning hydrocarbon liquid, fully compatible with modern vehicle fuels used to power our vast auto and truck fleet. Secondary product focus is on developing small scale LNG technology ("gas-to-liquid-to-gas") as well as examining feasibility of converting gas to dense hydrate solids for transport ("gas to solids").

The compelling driver for the GTL effort is to expand the options for the transport and marketability of the vast gas resources of Alaska's North Slope (ANS). Beginning as early as 5 to 8 years from now, upwards of more than 22 tcf of gas will be available from Alaska's giant Prudhoe Bay oil field as it becomes largely depleted, and the gas is no longer needed to maintain reservoir pressure. Including gas elsewhere on the ANS, as much as 300,000 to 700,000 bpd of GTL product for 20 to 30+ years is conceivable. Moreover, such product could ensure the economic and even operating feasibility of the ANS oil transport pipeline, now seeing its volume dwindle as ANS oil depletion becomes more pronounced.

GTL using Fischer-Tropsch (FT) technology is an obvious technology for ANS gas but one sorely tested by the economics of current state-of-the-art FT and the ANS's distant and inhospitable location and climate. Accordingly, GTL program emphasis is directed to advancing and demonstrating technology that can reduce first (conversion) step, expensive costs of syngas manufacture, as well as costs of subsequent syngas conversion to a liquid and any upgrading of such liquid to needed fuel products. In the latter efforts, the program has worked closely with the Transportation Fuels and Chemicals group which has common technology. Because of the likely interest of public and private Alaskan stakeholders to make gas utilization decisions in the near term, the GTL

program has particular interest in early delineation of optimum fuel products it can make so as to enhance GTL process economics in the face of extra capital plant costs associated with remote Alaska. The same near term driver is seen for small offshore GTL units that may aid recovery of oil and gas now being found beyond pipeline reach in the deep Gulf of Mexico.

Overall Program Goals

- Delineate, test and/or demonstrate GTL-FT process enhancements and liquid fuel product mixes that can enhance the economics of utilizing stranded domestic gas, thereby reducing and even eliminating public and private subsidies that may be necessary to market our remote natural gas beginning in the 2005-2008 period.

- Develop novel methods of upgrading low quality natural gas to meet pipeline specifications.

Research Objectives for this Solicitation

♦ **Fischer-Tropsch (FT) Process Components and Integration**

Develop and demonstrate advances in one or more parts of multi-step FT gas conversion processes and/or their integration to improve the prospective economics of stand alone GTL operations and/or those integrated with other product manufacture, suitable for prospective U.S. locations. Components include equipment, catalysts, etc., to technology steps such as syngas manufacture, product separation and the like.

♦ **Product Tailoring**

Delineate and demonstrate FT process adjustments required to customize GTL products that would maximize GTL contribution to the ultraclean motor vehicle fuel mix needed in the next decade. Performer must be able to document fuel performance enhancement.

♦ **Gas Upgrading**

Demonstrate new natural gas upgrading technologies to show the market potential for new and economic gas upgrading methods.

End Area 10 Description

Delete Areas of Interest 11), 12), and 13).

Replace **14) OIL AND GAS – EFFECTIVE ENVIRONMENTAL PROTECTION** with the following:

14) OIL AND GAS -- EFFECTIVE ENVIRONMENTAL PROTECTION

Background

The Oil and Gas Environmental program focuses maximizing domestic oil and gas production by reducing the cost of effective environmental protection. Most oil and gas production in the U.S. is from mature fields. Many wells are nearing their economic limit. This program works to reduce the costs associated with complying with state and federal environmental regulations.

The present R&D effort emphasis is on environmental technologies that provide new approaches to solving environmental compliance problems.

Overall Program Goals

- Enable industry to reduce compliance costs and improve environmental performance by providing lower-cost compliance technologies.

- Improve access to public lands and sensitive environments by demonstrating environmentally protective technologies.

- Work with industry organizations, government regulators, and other interested parties to generate and transfer new technologies and data that will lower environmental impacts and wastes in upstream processes.

- Provide sound science for the future regulatory framework affecting the industry.

Research Objectives for this Solicitation

♦ **Air Emissions**

Develop technologies to reduce air emission compliance costs for oil and gas operations, including improved modeling to accurately predict emissions from such activities.

♦ **Waste Handling and Disposal**

Develop or optimize technologies to reduce the cost of handling, treating or disposing of wastes associated with oil and gas operations, including tank bottoms, NORM contaminated materials and produced water.

- **Remediation**

  Develop technologies to reduce the cost of clean-up for soil and groundwater contaminated by oil and gas activities, especially in sensitive or pristine environments.

- **Regulatory Streamlining**

  Develop or demonstrate technologies or methodologies that will streamline environmental regulations or regulatory processes.

- **Access Issues**

  Develop or demonstrate environmental technologies that will improve access to public lands or that will allow regulators to make faster and better permitting decisions for oil and gas operations.

End Area 14 Description

Add Area of Interest #15 as follows:

15) OIL TECHNOLOGY -- EMERGING PROCESS TECHNOLOGY

Background

The Oil Processing Program (OP) is driven by the market need for cleaner burning transportation fuels from petroleum feedstocks. It supports fundamental and applied research directed toward producing clean fuels, lessening environmental impacts, improving process efficiencies, and providing sound science for implementation of regulations by developing new, innovative technologies to prevent pollution and minimize waste, with Federal support, to assure that appropriate national levels of environmental quality are achieved without a decimating effect on the economy or the nation's standard of living.

The principal program driver is environmental. Vehicles currently account for a large portion of urban and regional air pollution, including carbon monoxide, nitrogen oxides, volatile organic compounds, and particulates. The market is demanding fuels that produce extremely low emissions. Clearly, oil must contribute the bulk of these fuels in the foreseeable future. That challenge will require fuels that continue to change to answer the need for increasingly stringent emissions requirements.

One present R&D emphasis is on the biodesulfurization of heavy crudes to raise the value of the crude to the producer and to facilitate low-sulfur fuel production from these crudes. However, other processes are acceptable if they meet the economic, environmental and quality criteria demanded by the market. A second emphasis is to

provide fundamental science for developing environmentally sound processes or the science to assure proper implementation of proposed regulations.

Overall Program Goals

- Help the U.S. oil industry maintain its viability by developing cost-effective and environmentally acceptable heavy oil and residual upgrading and refining technologies, while increasing processing efficiency and reducing environmental impacts.

- Assist the industry with data to maintain the U.S. technological lead in producing clean fuels at reasonable cost while keeping emissions at the lowest reasonable level.

- Work with industry organizations, government regulators, and other interested parties to generate and transfer new technologies and data that will lower environmental impacts and wastes in the processing of crude oils.

- Provide sound science for the future regulatory framework affecting the industry.

Research Objectives for this Solicitation

Process Development

- Develop/enhance diesel biocatalytic desulfurization technology for the efficient removal of sulfur compatible with Alaskan refineries using North Slope crude oil, and provide sufficient data for a complete process design. Design information shall include, at a minimum:

    - Kinetics.
    - Reactor operating conditions.
    - Feedstock and product properties.
    - Further processing requirements.
    - Enzyme recycle/generation/makeup rates and concentrations necessary for meeting kinetics.
    - ISBL and OSBL estimates.
    - Sizing and properties for vessels.
    - Water and utilities requirements.
    - Length of operation between turnarounds.
    - Turnaround time.
    - Availability of enzymes and any other critical materials (include time from order to delivery for process critical materials).

- Perform economic analysis of process to determine viability

- A refiner must be, at the least, part of the proposed team to evaluate and confirm validity of design information and economic analysis.

End Area 15 Description

----- End of Amendment -----